

MORE than ten years ago Prof. Landolt described a series of experiments which were considered to throw doubt on the law of the conservation of mass in chemical action, and in 1901 Heydweiller concluded that a change in the total mass had been experimentally established in a number of cases. In a paper published by Antonino Lo Surdo in the *Nuovo Cimento* (1904, series 5, vol. viii.), the question is re-investigated. By excluding all possible sources of error, such, for instance, as a difference of temperature in the two arms of the balance, differences of volume of the vessels used, it is established that the change of mass due to the interaction between iron and basic copper sulphate, which by Heydweiller was considered to be about 0.2 milligram, in reality falls within the limits of the error of weighing, being certainly less than 0.02 milligram. In the experiments described, the sealed tubes in which the interaction took place were not removed from the balance during the whole of the series of weighings, and an ingenious mechanism was designed by which the tubes and weights were manipulated within the case.

THE operations of the Smithsonian Institution during the year ending on June 30, 1904, and the work of the U.S. National Museum, the Bureau of American Ethnology, the International Exchanges, National Zoological Park, and the Astrophysical Observatory, are described in Dr. S. P. Langley's report which has just reached us. Among the matters mentioned is the removal of the remains of James Smithson, founder of the Smithsonian Institution, from the British cemetery at Genoa to America, at the beginning of last year. The report states that the remains rest temporarily in a room at the Smithsonian Institution containing a few personal relics of Smithson, awaiting their final disposal by the Regents. Dr. E. W. Scripture, of Yale University, has been awarded a grant from the Hodgkins fund for the construction of a "vowel organ." Dr. Scripture expects to be able to construct an organ which can sing the vowels, or a vowel register which, attached to a pipe organ, may be used effectively in church music. An exploration of some of the glaciers of British Columbia has been undertaken by Dr. W. H. Sherzer, under the auspices of the Smithsonian Institution, for the purpose of gathering definite information regarding glacial phenomena, such as the nature and cause of the ice flow, the temperature of the ice at various depths, and its relation to air temperatures, the amount of surface melting, and the possible transference of material from the surface to lower portions. Reference is made in the report to the new building of the National Museum in course of erection in the Smithsonian Park. The floor area in the four stories of the new building will be about $9\frac{1}{2}$ acres. The accessions to the museum in the year covered by the report amount to 241,547 specimens, which bring the total number of objects in the collections up to nearly six millions. The work of the astrophysical observatory has been chiefly concerned with solar radiation, and its possible variability. The investigations point to the conclusion that the radiation supplied by the sun may perhaps fluctuate within intervals of a few months through ranges of nearly or quite 10 per cent., and that these fluctuations of solar radiation may cause changes of temperature of several degrees centigrade nearly simultaneously over the great continental areas of the world.

The latest report issued by the Engineering Standards Committee deals with British standard specification for structural steel for marine boilers. Copies may be obtained from Messrs. Crosby Lockwood and Son at 2s. 6d. net.

NO. 1847, VOL. 71]

MESSRS. HENRY SOTHERAN AND CO. have issued a new catalogue of second-hand books, containing works on mathematical, astronomical, physical, and chemical subjects. The works catalogued include the library of the late Prof. A. W. Williamson, F.R.S., and many important foreign works on the exact sciences published within the past twenty years.

OUR ASTRONOMICAL COLUMN.

THE ALTERNATING VARIABILITY OF MARTIAN CANALS.—During 1903 Mr. Lowell observed an apparent alternation in the visibility of the Martian canals Thoth and Amenthes, which he suggested might be due to the artificial regulation of a deficient water supply for irrigation purposes (*NATURE*, vol. lxi. p. 496).

In a telegram, dated March 10, communicated to Prof. E. C. Pickering and published in No. 4003 of the *Astronomische Nachrichten*, Mr. Lowell announces that he has again observed "a functional alternative visibility" of these two canals, both of which are double.

DISCOVERY OF JUPITER'S SIXTH SATELLITE.—In No. 100 of the *Publications of the Astronomical Society of the Pacific*, Profs. Perrine and Aitken describe the first observations of Jupiter's sixth satellite, and abstracts of their communications are published in No. 4002 of the *Astronomische Nachrichten*.

Prof. Perrine states that several years ago it was proposed that the Crossley reflector, when reconstructed, should be employed in a search for additional satellites to the outer planets. In accordance with this programme, photographs of Jupiter were taken on December 3, 8, 9 and 10, 1904, and a comparison of them showed that the planet, which was slowly retrograding at the time, was apparently accompanied by an object of the fourteenth magnitude. Photographs taken on January 2, 3 and 4 showed that the newly discovered object was following Jupiter in such a manner as to suggest its dependence on that body. The greatest elongation (west) of the new satellite, about $50'$, seems to have been passed on December 25, and the inclination of its orbit to the ecliptic appears to be greater than those of the inner satellites. The direction of the satellite's motion, although apparently retrograde, cannot be determined until further observations have been made.

On January 28, Prof. Aitken, using the 36-inch refractor under unfavourable atmospheric conditions, found the satellite quite easily, using the position predicted from the Crossley photographs, and, after a few minutes' observation, the identification was confirmed by the motion in right ascension. Following the object for nearly an hour, he found it to have an hourly motion in R.A. of about $+20'$, and this agrees with the photographic result. A comparison with neighbouring faint stars showed that the satellite was about as bright as a star of the fourteenth magnitude.

FORTHCOMING OPPOSITIONS OF MARS.—As during the oppositions of Mars in 1905, 1907, and 1909 the planet will become successively more favourable for observation, Mr. R. Buchanan has communicated to *Popular Astronomy* (No. 3, vol. xiii.) the following figures, showing the respective conditions for each opposition:—

Year	Mars passes perihelion	Opposition	Distance from Earth	Brilliancy
1905	Nov. 7	May 8	0.543	36.8
1907	Sept. 22	July 5	0.411	75.4
1909	Aug. 13	Sept. 25	0.390	86.6

The sun's distance from the earth is taken as the unit of the mean "distance from earth." In the oppositions of 1901 and 1903 the respective apparent brilliancies of the planet were 20.0 and 23.4.

VARIABLE RADIAL VELOCITY OF SIRIUS.—In No. 70 of the *Lick Observatory Bulletins*, Prof. Campbell discusses the spectrographic observations of the bright component of Sirius made at Lick since 1896, thirty-one plates in all.

Before treating the main subject, however, he discusses the difficulty experienced in binary star work through the employment of numerous different systems of nomenclature to define the orbital elements, and then propounds a new

system which would be readily adaptable to all requirements, visual or spectroscopic.

The observations of Sirius have been made under varying conditions, instrumental and otherwise, and a better accordance in the individual results might be obtained by making the observations under uniform conditions. The resulting value, obtained from all the plates, gave the velocity of the system of Sirius as -7.36 km. per second. There is a marked progression among the individual values obtained for the velocity of the primary which is attributed to the effect of orbital motion. The sense of this progression indicates that the positive value of i (the inclination of the plane of the orbit) should be used. The above value, whilst disagreeing with others, agrees very well with the value obtained by Profs. Frost and Adams in 1901-2.

The values of the radial velocities of the centre of the system and of the primary and secondary components are given in a table, with yearly intervals, for a whole revolution, *i.e.* from 1870.09 to 1918.09, the time of the apastron passage being 1918.5110.

CONSTANT ERRORS IN MERIDIAN OBSERVATIONS.—In an address delivered to the astronomy section of the St. Louis International Congress of Sciences and Arts, Mr. J. G. Porter discussed the various sources of error to which meridian observations are peculiarly subject, and proposed various methods whereby the constant errors might be eliminated.

Among other methods for eliminating the magnitude error which affects right ascension determinations, he recommends the one proposed by Prof. Turner wherein the transits would be registered on a regularly moving photographic plate, the reticule wires being replaced by spots of light projected on to the plate at regular intervals from a fixed source.

Regarding declination observations, the error due to varying refraction is the most important, and Mr. Porter suggests that this might be eliminated by having a perfected system of fundamental stars well distributed over the sphere, from observations of which, on any evening, the deviation of the actual refraction from the assumed law might be determined and used to correct the observations. Another, more costly, method would be to have a number of observatories widely distributed in latitude, so that zenith observations, where refraction is non-effective, of more stars might be made. Mr. Porter considers the solution of this constant error difficulty in meridian observations to be one which is eminently suitable for international cooperation (*Popular Astronomy*, No. 3, vol. xiii.).

THE NATIONAL PHYSICAL LABORATORY.

ON Friday last the annual general meeting of the governing body of the National Physical Laboratory was held at that institution, when the report of work done in 1904 was received and the programme of work proposed for the forthcoming year approved. A number of guests were invited to meet the members of the general board and inspect the laboratory. Among those present were about thirty Members of Parliament, several colonial agents-general, and a representative gathering of leading physicists and engineers.

In the 45-page report submitted by the director, Dr. Glazebrook, are found particulars regarding the various researches and tests carried out during the past year, with special reference to the newer developments. The test work at Bushy for the year shows a marked growth, the total number of separate tests made having increased from 1330 in 1903 to 1906 in 1904, the increase being spread over almost all the different departments of the laboratory. These figures are distinct from the work of Kew Observatory, where in all more than 26,000 instruments were verified during the year.

In the engineering department, Dr. Stanton has made considerable progress with the research on the distribution of wind pressure over large areas, which forms a continuation of the important work embodied in his paper read at the Institution of Civil Engineers last session. A steel tower fifty feet high has been erected in the grounds,

carrying large and small pressure plates with the necessary gauges. From the general results of the observations made it would appear that the distribution of pressure on the windward side of a large plate in the open air falls off more rapidly from the centre to the sides than in the case of a small plate, but that the ratio of the pressures on the windward and leeward sides appears to be practically the same in both cases.

The research on the specific heat of superheated steam by the continuous flow method has been continued by Mr. Jakeman, who has been mainly occupied in contending with certain experimental difficulties, such as the attainment of sufficiently high insulation between the various parts of the electrical superheater, especially at low superheats. Some preliminary figures have been obtained which do not appear to confirm the rapid rise in specific heat shown by the results of some recent observers.

A testing machine for studying the effect of alternating stresses of varying periodicity on engineering materials has been constructed and was described in last month's *Engineering* by Dr. Stanton. It has already been used on a set of nickel-steel specimens, which are the basis of a research in the metallurgical department.

A new building has been erected to house the new standard leading-screw machine, which is now at work. Several standard screws have been cut and measured for use in Government arsenals.

Dr. Chree, at the observatory department, has been occupied with some important investigations on terrestrial magnetism, and the measurement and tabulation of some of the old Kew magnetic records. The men of science of the British Antarctic Expedition have, since their return in September last, had the opportunity of again comparing with recognised standards many of their instruments, and arrangements have been made for cooperation with them in the reduction of the mass of magnetic and meteorological data they brought home with them.

In the physics department numerous researches have been in progress. We have only space for mention here of some of the more important. Dr. Harker, in the thermometry division, has been occupied with preliminary work on which it is hoped may ultimately be based some new direct electrical method of very high temperature measurement. With this object he has undertaken a study of the resistance and thermoelectric properties of solid electrolytic conductors such as are used in Nernst lamps. The existence at high temperatures of large thermoelectromotive forces between rods of the various earths made up as ordinary thermojunctions has been securely established by direct electrometric methods, and a new form of electric furnace has been designed capable of continued use at temperatures above 2000° C. By means of these furnaces and a number of thermojunctions of widely different properties, a careful re-determination of the melting point of platinum was made. More than sixty determinations concurred in giving a value which differs considerably from that now accepted. The results of this work are embodied in a paper just sent in to the Royal Society.

The research on the specific heat of iron, which has been extended to temperatures above 1100° C., is complete, and will shortly be published.

In the electrical standards department, Mr. Smith has been mainly occupied with work on the standard ampere balance designed by the late Prof. Viriamu Jones and Prof. Ayrton for the British Association committee on electrical standards. The weighing mechanism was constructed by Mr. Oertling, and the four marble cylinders carrying the coils have been successfully wound and insulated at the laboratory. On each cylinder are two double helices of bare copper wire. Though the air space between the consecutive turns is less than 0.006 inch, an insulation resistance over 30,000 megohms was finally secured for each of the coils. Many accessories have been constructed, and the outlook for a speedy determination of the absolute unit of current to at least one decimal place further than hitherto attained is very hopeful.

In electrotechnics, Mr. Paterson has installed large cells for ammeter verification, and for alternate current measurements a specially constructed set of Mr. Addenbrooke's instruments, and a Kelvin voltmeter with circular scale of $2\frac{1}{2}$ metres radius. In photometry have been included in-